

degrees of expansion or retraction of individual cavities 125, for example, a half expanded state and a fully expanded state, depending on the type of user interface scenario.

[0050] 3. Third Preferred Embodiment: Selective Expansion of Groups

[0051] In the third preferred embodiment, as shown in FIGS. 14-15, a first group of cavities 125 and a second group of cavities 125 are selectively expanded. Similar to the second preferred embodiment, the displacement device 130 of the third preferred embodiment preferably expands the first and second groups of cavities 125 in two modes: a first mode where only one of the first and second groups of cavities 125 is expanded, and a second mode where both of the first and second groups of cavities 125 are expanded. Alternatively, the displacement device 130 may expand only one of the first and second groups 125 at any one time. Each group of cavities 125 are preferably arranged as described in the first preferred embodiment and preferably functions to provide a particular interface for the user and preferably includes a number of cavities 125 suitable for the application, for example, a number dial pad or a QWERTY keyboard. The groups of cavities 125 may be placed adjacent to one another (for example, a QWERTY keyboard group adjacent to a number dial pad group, as shown in FIG. 15a) and/or interspersed with one another (for example, the QWERTY keyboard group is interleaved with the number pad group, as shown in FIG. 15b). In this variation, the branches of the channel 138 that couple each of the cavities 125 to the displacement device 130 may be arranged along different height levels within the sheet 111, as shown in FIG. 16. This may allow for the branches of the channel 138 to be arranged within a sheet in with a surface 115 of a lower surface area and/or allow each of the plurality of cavities 125 to be placed in closer proximity to each other. The branches of the channel 138 may be arranged in one of a variety of arrangements. In a first example, the branches coupling the cavities of the first group of cavities 125 to the displacement device 130 may be placed along a first height level within the sheet 111 and the branches coupling the cavities of the second group of cavities 125 to the displacement device 130 may be placed along another height level within the sheet 111. In a second example, the branches leading to each cavity 125 within one group of cavities 125 may be arranged on different height levels within the sheet 111. In a third example, the branches coupling a first subset of the cavities within a group of cavities 125 to the displacement device 130 may be arranged on a first height level within the sheet 111 and the branches coupling a second subset of the cavities within the group of cavities 125 to the displacement device 130 may be arranged on another height level within the sheet 111. The branches of the channel 138 may be arranged in any suitable combination of the above examples. However, any other suitable arrangement of the channel 138 within the sheet 111 may be used.

[0052] As shown in FIG. 14, similar to the second preferred embodiment, the third preferred embodiment includes a channel 138 that couples a first group of cavities 125 and a second group of cavities 125 to the displacement device 130. The first and second groups of cavities 125 are preferably not directly connected to each other. The channel 138 preferably forms a T-junction between the displacement device 130 and the two groups of cavities 125, and the channel preferably includes a valve 139 at the T-junction to direct fluid displaced by the displacement device 130 to one or both of the groups of cavities 125. However, the channel 138 may be of any other

suitable orientation. The valve 139 is preferably of the type described above in the second preferred embodiment. In a variation where one cavity 125 may belong to more than one group of cavities 125, for example, as shown in FIG. 17 where a first group of cavities 125 that correlate to a landscape QWERTY keyboard and a second group of cavities 125 that correlate to a portrait QWERTY cavity 125 group share cavities 125. The shared cavities 125 may be thought of as a third group of cavities 125 that cooperates with the first group of cavities 125 to correlate to a landscape QWERTY keyboard and cooperates with the second group of cavities 125 to correlate to a portrait QWERTY keyboard. In this variation, each of the shared cavities 125 may be coupled to more than one channel 138, as shown in FIG. 18. This allows expansion of each shared cavity 125 when any of the displacement devices 130 pertaining to each of the groups to which the cavity 125 belongs is activated. To regulate the expansion of the cavity 125, the cavity 125 may include a valve of a type described above for valve 139 that prevents fluid from a first channel 138 belonging to a first group to flow through the cavity 125 to a second channel 138 belonging to a second group. The valve may also be used to prevent fluid from more than one channel 138 to expand the cavity 125, which may potentially cause the over-expansion of the cavity 125. However, any other suitable arrangement of a cavity 125 that may belong to more than one group may be used.

[0053] Similar to the second preferred embodiment, the third preferred embodiment preferably includes a processor that controls the displacement device 130 and the valve 139. The processor preferably regulates the volume of fluid that is displaced by the displacement device 130 and/or the volume of fluid that enters and exits the cavities 125 to expand and retracts the cavities 125 to prevent over expansion and over retraction. The processor preferably also determines if one (and which one) or both of the groups of cavities 125 is to be expanded. If the number of cavities within the first group of cavities 125 is different from the number of cavities within the second group of cavities 125, the processor preferably regulates the volume of fluid that is displaced by the displacement device 130 to accommodate for the difference in volume of fluid necessary to expand each group of cavities 125. In all other respects, the processor of the third preferred embodiment is preferably similar or identical to the processor of the second preferred embodiment.

[0054] 4. Fourth Preferred Embodiment: Concurrent and Selective Expansion of Cavities

[0055] In a fourth preferred embodiment, as shown in FIGS. 19a-19d, the displacement device 130 preferably expands a first cavity 125a and one of a second cavity 125b and third cavity 125c at one time. Similar to the first preferred embodiment, the first cavity 125a is expanded concurrently with the expansion of any one of the second and third cavities 125b and 125c. Similar to the second preferred embodiment, the displacement device 130 of the fourth preferred embodiment preferably expands the second and third cavities 125b and 125c in two modes: a first mode where only one of the second and third cavities 125b and 125c is expanded, and a second mode where both of the second and third cavities 125b and 125c are expanded. Alternatively, the displacement device 130 may expand only one of the second and third cavities 125b and 125c at any one time. A variation of the fourth preferred embodiment may be similar to the third preferred embodiment. In this variation, the displacement device 130 may function to expand a first group of cavities